DEVELOPMENT OF ABSORBENTS AND HARDWARE FOR REMOVAL OF TRACE OXYGEN, WATER VAPOR AND HYDROCARBON CONTAMINANTS

P.K. Sharma, G.S. Hickey, and R. Zanteson
Jet Propulsion Laboratory
California Institute of Technology
Pasadena, CA 91109

[Abstract]

Avoiding microcontamination has received a great deal of attention lately. Among areas of relevance, the processing of metals and alloys in the semiconductor industry requires ultra clean environment. Even trace amounts of oxygen, water vapor, and hydrocarbons can introduce undesired impurities in the processed materials and cause unexpected aberrations over the desired properties. The conventional method of providing a high purity environment is the production of a high purity inert gas and using this gas to constantly purge the processing chamber. This approach is costly due to consumption of a large amount of high purity gas. The alternative approach described here is the generation of a high purity inert gas, and recirculating it to provide the ultra clean environment in a self contained closed loop system. Novel catalytic regenerable absorbents were developed[1-3] at JPL for oxygen removal and the mechanism of their oxygen removal was investigated[4-6]. A hydrophobic adsorbent[7] for light hydrocarbons was also developed at JPL. A closed-loop system[8] which uses the developed absorbents in regenerable cartridges for removal of various impurities has been developed. This system consists of three cartridges connected in series for removal of oxygen, water vapor and light hydrocarbons in succession. The high purity inert gas (e.g. argon) obtained after scrubbing through the cartridges is recirculated through the system by means of an all metal bellows pump and provides a constant purge of the contaminants generated in the processing chamber. Excellent operation of the closed-loop system has been demonstrated, with trace oxygen and water vapor removed to below the measurement limit of conventional instruments and near complete removal of light hydrocarbons.

REFERENCES

1. Sharma, P. K., and Seshan, P. K., "Copper modified carbon molecular sieves for selective oxygen removal," US Patent No. 5,081,097.
2. Sharma, P. K., and Seshan, P. K., "Copper crystallite in carbon molecular sieves for selective oxygen removal," US Patent No. 5,219,819.
3. Sharma, P. K., "High temperature sorbents for oxygen," US Patent Application filed, 1993.
4. Sharma, P. K., and Seshan, P. K., "Copper oxide modified carbon molecular sieves for selective oxygen removal," Gas Separation & Purification 4 (1990) 203.
5. Sharma, P. K., and Seshan, P. K., "Activation of copper dispersed on a zeolite for oxygen sorption," emically Modified Oxide Surfaces Vol. 3, editors Leyden, D. E., and Collins,

W. T., Gordon and Breach, New York (1990) pp. 65-80.
6. Sharma, P. K., and Hickey, G, S., Gas Separation & Purification 7 No. 3 (1993) 141-146.
7. Sharma, P. K., and Hickey, G. S., "A size selective hydrophobic adsorbent for organic contaminants," NASA technical brief, N PO-19129.
8. Sharma, P. K., "A closed-loop gaseous contaminant removal system," NASA technical brief, NPO-18879.